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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/628,198   | 07/28/2003  | Young-Joon Park      | TI-35623            | 6116             |
| 23494  | 7590        | 08/13/2004           | EXAMINER            |                  |
| TEXAS INSTRUMENTS INCORPORATED<br>P O BOX 655474, M/S 3999<br>DALLAS, TX 75265 |             |                      | PERALTA, GINETTE    |                  |
|  |             |                      | ART UNIT            | PAPER NUMBER     |
|  |             |                      | 2814                |                  |

DATE MAILED: 08/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/628,198

Applicant(s)

PARK ET AL.

Examiner

Ginette Peralta

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 3, 5, 6, and 7 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Park et al. (U. S. Pat. 6,709,970 B1).

Park et al. discloses a method of manufacturing copper interconnects on a semiconductor wafer, the method comprising forming a layer of patterned dielectric material as shown in fig. 2, said patterned dielectric material defining spaces for said copper interconnects; depositing a copper seed layer 90 over said layer of patterned dielectric material; depositing a first layer of copper grains 100 having a first initial grain size over said copper seed layer, said first layer of copper grains being deposited by an electroplating process, and depositing a second layer of copper grains 130 having a second initial grain size over said first layer of copper grains, said second layer of copper grains being deposited by an electroplating process; wherein said first initial grain size is smaller than said second initial grain size (col. 6, ll. 29-31); wherein the

method further comprises annealing the semiconductor wafer within a temperature range of 150°C to 300°C (col. 2, ll. 40-45).

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (U. S. Pat. 6,709,970 B1) in view of Andricacos et al. (U. S. Pat. 6,709,562 B1).

Park et al. discloses a method of manufacturing copper interconnects on a semiconductor wafer, the method comprising forming a layer of patterned dielectric material as shown in fig. 2, said patterned dielectric material defining spaces for said copper interconnects; depositing a copper seed layer 90 over said layer of patterned dielectric material; depositing a first layer of copper grains 100 having a first initial grain size over said copper seed layer, said first layer of copper grains being deposited by an electroplating process, and depositing a second layer of copper grains 130 having a second initial grain size over said first layer of copper grains.

Park et al. discloses the claimed invention with the exception of depositing at least one additional layer of copper grains of any initial grain size over the second layer of copper grains.

Andricacos et al. discloses a method of depositing a copper layer in a patterned dielectric material which includes the deposition of the copper layer in a three step electroplating process, wherein the composition of the copper filling is varied for the disclosed intended purpose of obtaining three different grain sizes and resulting in a copper layer having improved electromigration resistance without leaving voids or seams in the feature.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit at least one additional layer of copper grains having an initial grain size by an electroplating process as Andricacos et al. discloses for the disclosed intended purpose of obtaining three different grain sizes and resulting in a copper layer having improved electromigration resistance without leaving voids or seams in the feature.

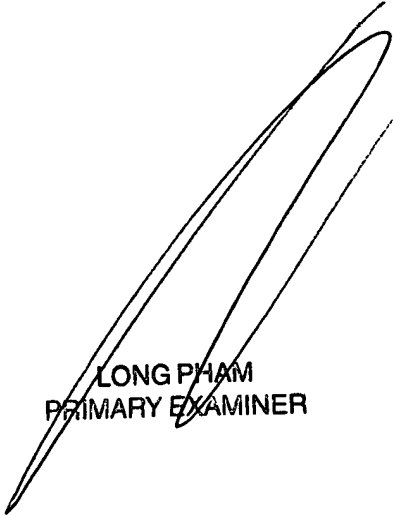
### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ginette Peralta whose telephone number is (571)272-1713. The examiner can normally be reached on Monday to Friday 8:00 AM- 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571)272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GP



LONG PHAM  
PRIMARY EXAMINER